



# Peak 97, a Climbing Game

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## SUMMARY

I've posted a video of the gameplay to Flickr: <http://www.flickr.com/photos/8190411@N07...>

I have been slowly working on a series of automatons and robotic effigies of my coworkers as a way to exercise my creativity without cluttering the house with kid-unfriendly creations. My two main design criteria were low cost and uniqueness. Builds included a stand-up paddle-boarder; a duct-tape speed boat; a soda-can steam-powered jet ski; and a wheeled, obstacle-avoiding room-roamer with a cross-country skiing action. For my next trick, I thought it would be fun to try something climbing-related. You may have noticed the outdoor theme here. I work for REI, a large consumer co-operative charged with inspiring, educating and outfitting folks for a lifetime of outdoor adventure.

I knew it was going to be tricky to build a climber inexpensively. All the climbing bots I could find on the web used either magnetic wheels (not authentic enough for me) or enough servos to blow my budget ten times over. I thought perhaps I could reach my goal by tweaking the leg shapes of a bi-core walker, a popular BEAM design. Some experimentation later, I found I could coax a climbing action given a sloped and carpeted surface. I played around with carpet-covered sheet metal and super-magnets on the hands and feet, but the sheet metal was going to add too much time and cost to the project. I settled on sharp hands and feet moving up a carpeted plywood surface, as that perfectly matched the scrap materials I already had on hand.

Unfortunately, mounting batteries was going to be tricky, as the center of gravity was touchy enough with just the servos hanging out on the back. Cramming on tiny sensors and compact control circuitry also seemed like more work than I wanted to put into this project,

especially considering that most of the other creations in this series took less than two hours. As such, I moved to a tethered design, but then had to decide how the tethers would affect the climbing action. It would be great if the tether hung like a tail, but I couldn't keep the climber's arms on the wall with the added weight.

Having decided that the tethers would be top-ropes, so to speak, the idea struck me that I could make a game of it, two climbers racing against each other. After that, it was just a matter of implementation and refinement.

One Arduino reads the pots and controls the climbers' servos while the other Arduino handles the game mechanics: power, LCD, timing, music, and win detection.

The single button turns everything on or off with a Polulu Power Switch. Upon power-up, there is a brief title screen, a plea for gentility, and then the countdown begins. When the race starts, the control Arduino signals the climber Arduino to start mapping the servos to the pots.

Both climbers use the same three-dollar servos I ordered direct from Hong Kong. One climber is significantly longer than the other, but less stable. Rather than perfect each climber, I chose to leave them a little rough and hard to handle. In the future, I may add obstacles to the climbing wall, but I want to first see how things go with a blank wall.

My first versions of the sheet aluminum arms and legs terminated in digits crudely shaped with oversized tin snips. These held the carpet passably, but threw off the steering. I installed tacks in each hand and foot, making a world of difference in grip and control. I really wanted the hands to be holding ice axes, as ice axes were the reason for founding REI. Unfortunately, the added length messed up the geometry. Perhaps I'll revisit the idea when the current climbers break. Yes, I don't expect any of my parts to last long at the hands of enthusiastic players.

Anyway, the spikes are connected to ground, and the wall's aluminum snow caps are each connected to a pin on the control Arduino. The winner is announced, either Mary or Lloyd (the names of the couple that founded REI), and the elapsed time is displayed. I considered storing high scores in the EEPROM, but they wouldn't have meant as much without the players' names, and text entry is another thing beyond the scope of this cheap and lazy project. As such, the winner has 30 seconds to scribble down their score on a chalkboard or tweet a picture of the display hash-tagged #peak97.

Until we can that pool table in the break room at work, this'll be the next best thing :)

## Step 1 — Peak 97, a Climbing Game



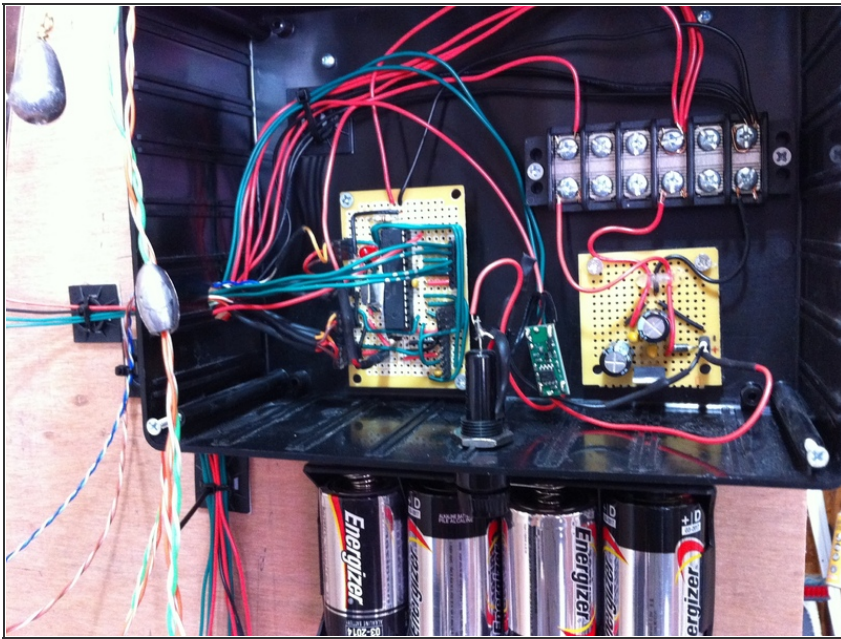
- You'll need a carpet-covered mountain. I used eighth-inch plywood connected by a piano-hinge. Be sure to spread the carpet glue (I used Liquid Nails) with a putty knife so the carpet is uniformly secured. I added two separate aluminum "snow caps" to act as electrical contact points to detect which climber wins.

## Step 2



- The Arduino that reads the pots and controls the climbers is in the box on the back side, right above the 4D battery holder. Add some tape to the meeting point of the snow caps to keep the wires from snagging and to keep the snow caps from touching each other. Keep the back side of the game as neat as possible to avoid snags as the climbers climb.

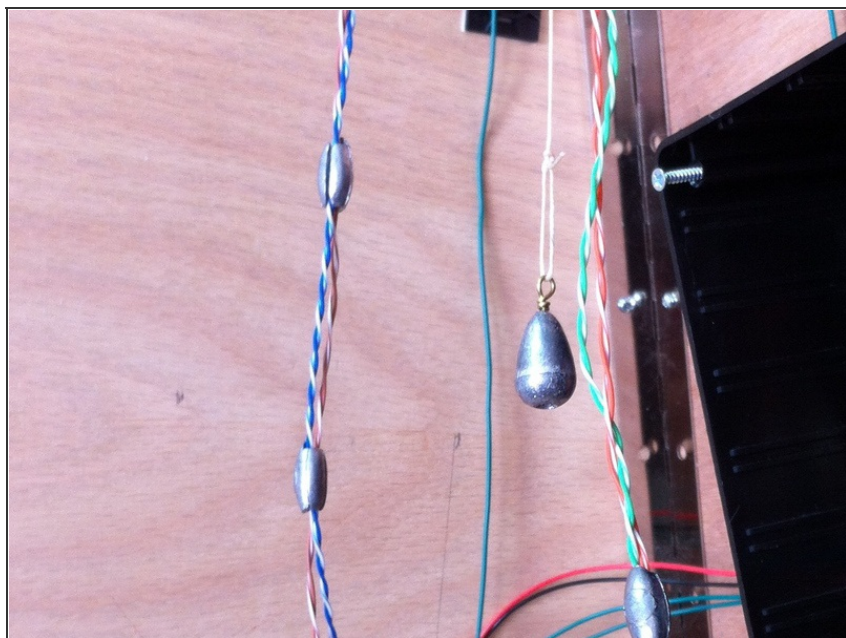
### Step 3



- One scratch-built Arduino, a fuse holder, a Polulu Power Switch, a low-dropout power supply (shared by both Arduinos), and a terminal strip that eased connections as I brought various parts online during the build.

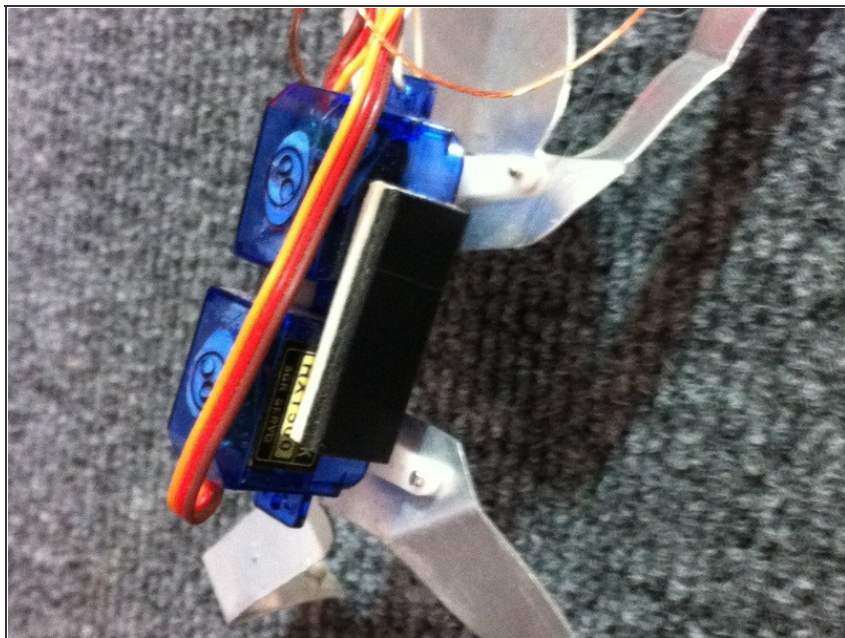


## Step 4



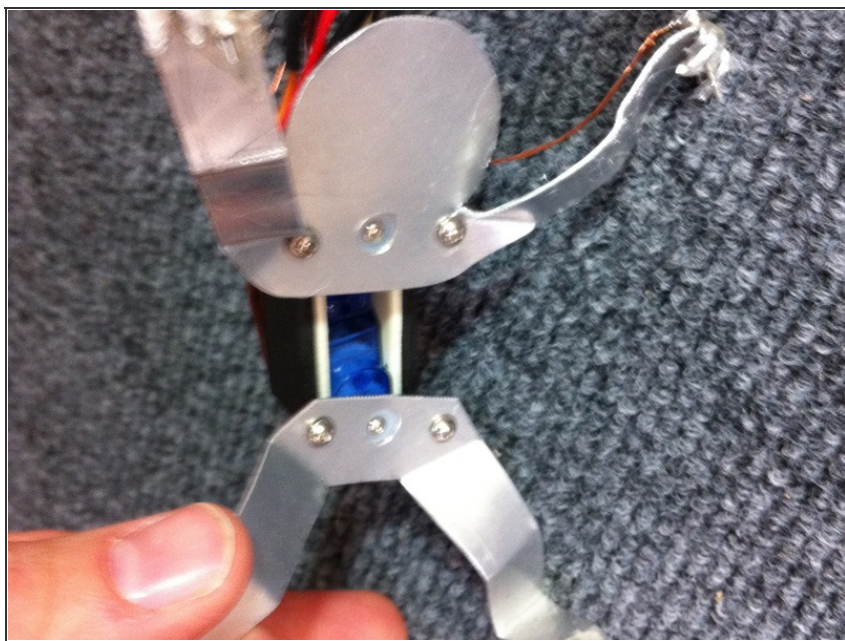
- Each climber's "rope" consists of two twisted pairs stolen from a Cat 5 network cable. Make sure to get the flexible variety that uses stranded wire. Otherwise your ropes won't get out of the way as the climbers climb.
- Strategically place fishing weights to counterweight the climber and the amount of wire on the other side of the peak. The 3/4 ounce weight is for the climber and some wire. The inline 1/4 ounce weights counteract the initial full load of wire, but descend to the other side of the droop as the climber climbs and less weight is needed. If you get the weights wrong, you'll have a terrible time keeping all of the climbers' hands and feet on the wall.

## Step 5



- Each climber consists of two micro servos joined by foam tape and scraps of plastic. The arms and legs are cut and formed from small sheets of aluminum, available at your local hardware store.
- You may to build the climbers first, as I did. Then you can test various slopes for your carpet mountain.

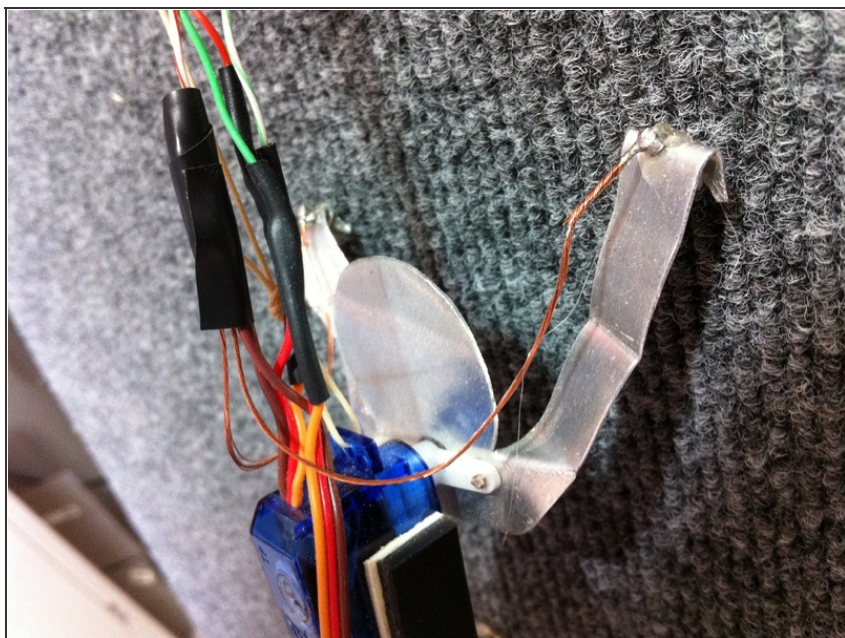
## Step 6



- You'll want to form the limbs to keep the servos as close to the wall as possible while still keeping the tacks deep into the carpet.



## Step 7



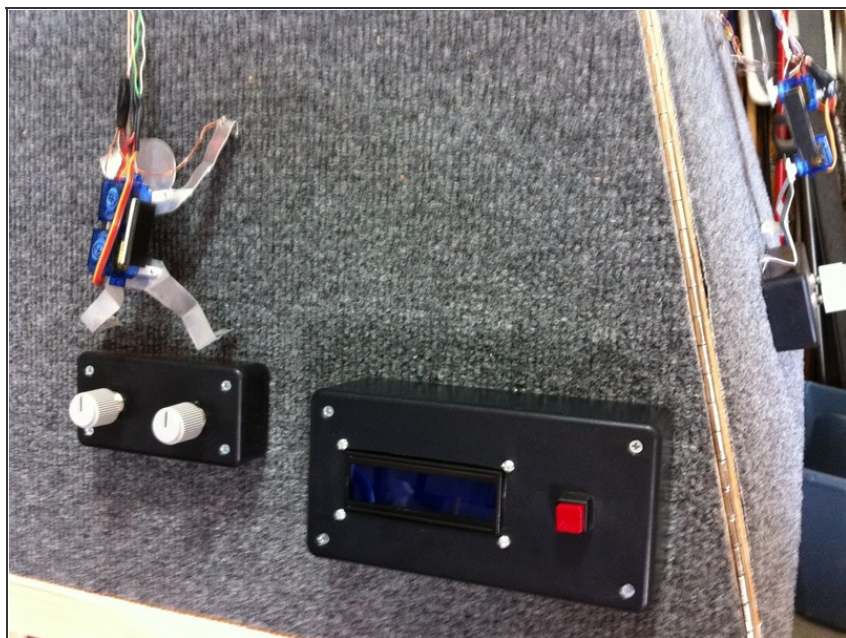
- If you want the full gaming experience, you'll want to wire the hands to ground so that the control Arduino can detect which climber wins. I tried using a small jumper to the aluminum but the hot glue holding the tacks in the hands wasn't conducting, so I wired the tacks directly, then glued them in.

## Step 8



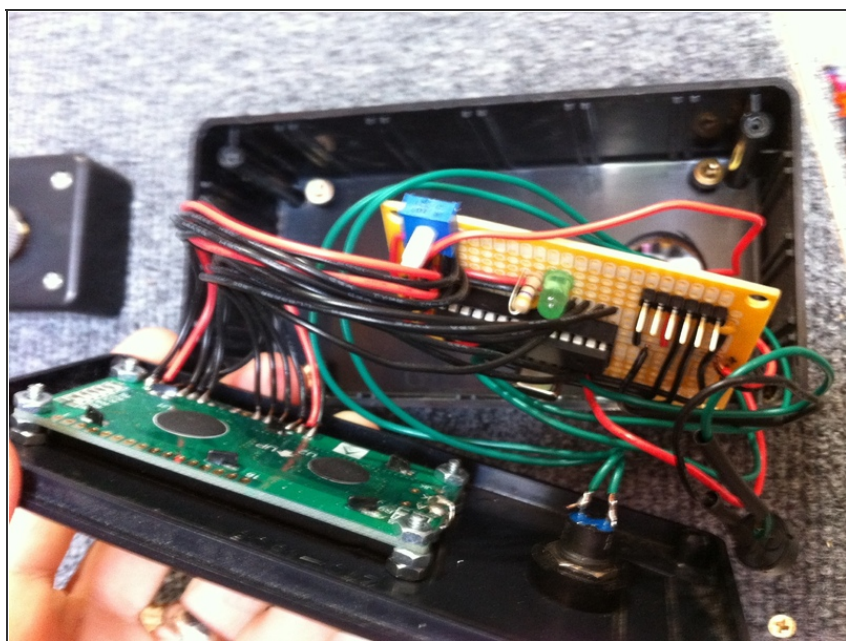
- The feet don't need to conduct, so slop on the glue.
- Make sure you have the tacks from all hands and feet engaging the wall evenly and at appropriate angles. Problems with the tacks or with arm/leg length will make steering difficult.

## Step 9



- I wanted to mount the control box so both players could see it, but decided against hanging it out to be bumped by passersby.
- Ensure that it's angled well enough for the LCD to be readable without leaning back or squatting.

## Step 10



- The control box is a great place for the control Arduino, as it has many connections to the LCD. I used the \$12 LCD from Adafruit, as well as one of their piezo buzzers (bottom right) for my music.

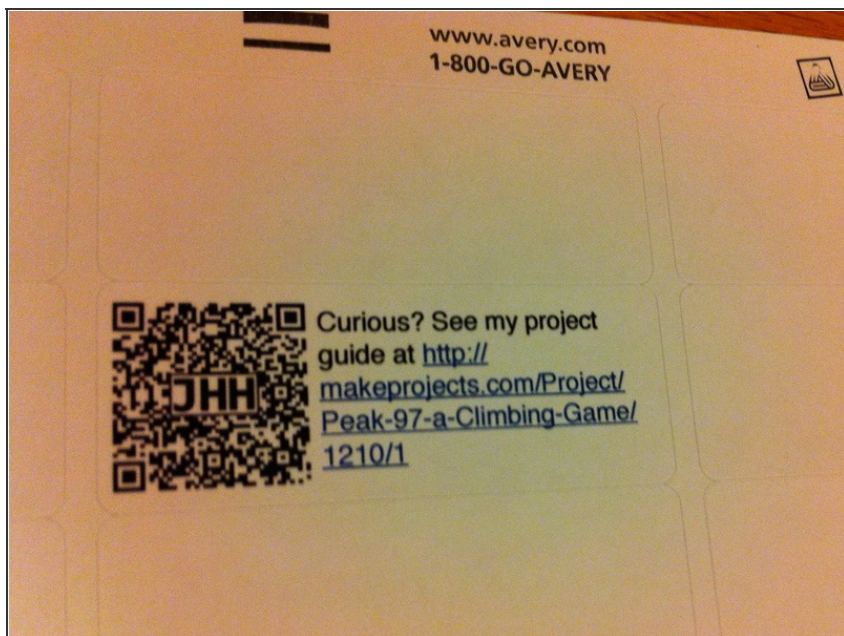


## Step 11



- While I programmed the climber Arduino before I even built the climbers, I didn't program the control Arduino until I had the rest of the game assembled. Your mileage may vary, as they say.
- It's time, if you have not yet done so, to name your creation and consider some theme music and other aspects of gameplay.
- I would have posted my code, but it's nothing special, and if you don't know offhand how to write such things, I guarantee you'll have fun learning.

## Step 12



- And lastly, should those out in meatspace see your nifty project and be inspired to build their own, don't forget to slap a custom QR code on it, linking to your project guide.